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*Contact: Jane Sanders (404-894-2214)  
E-mail: (jane.sanders@edi.gatech.edu)  
or John Toon (404-894-6986)*

## **DENTISTRY BY DESIGN: AEROSPACE TECHNOLOGIES MAY MAKE DENTISTRY MORE EFFECTIVE AND EFFICIENT**

The marriage of dentistry and aerospace engineering will soon yield new "virtual mouth" technology to help orthodontists and dentists accurately calibrate movement of teeth, and help precisely design and speed manufacturing of restorations and replacement teeth.

Experts in aerospace engineering at the Georgia Tech Research Institute (GTRI) collaborated with dentist Dr. Randy Muecke of Atlanta and orthodontist Dr. David Leever of Tampa, Fla., to enhance the practitioners' patented DentAART Inc. technology.

Dentists have long needed an exact anatomic capture of their patients' tooth position and form. DentAART precisely captures that anatomic relationship and creates a unique prescription for use in planning and delivery of facial procedures - restorative, orthodontic or surgical.

Muecke and Leever brought DentAART to GTRI researchers to confirm Leever's mathematical proof of the technology. Then they contracted with GTRI to develop a digital version of DentAART, including individualized patient functional movement. Jeffrey J. Sitterle, GTRI's chief scientist and an expert in sensing systems and computer simulation, led the research and development efforts.

Georgia Tech Research News & Publications Office  
430 Tenth Street, N.W., Suite N-116 404-894-6986 (tel)  
Atlanta, Georgia 30318 USA 404-894-4545 (fax)  
Web: [gtresearchnews.gatech.edu](http://gtresearchnews.gatech.edu)



*GTRI researcher Shayne Kondor (right) and graduate student Paul Lowe work on a digital version of patented technology called DentAART.*

He and other GTRI experts took the idea further and offered a way to computerize the method and create a system for multiple applications. Measurements made from at least

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three high-resolution X-rays or a computerized tomography (CT) scan are fed into a computer. Specialized software generates a precise 3D digital image of a patient's mouth.

Based on this 360-degree image, dentists can design a complete treatment plan to help them know exactly how they need to move and restore teeth. Then, improvements in materials processing and fabrication can rapidly produce a crown or restoration that dentists simply glue in place. Restorations can be precisely calibrated to the bite pattern of the tooth to be replaced.

The use of this enhanced technology, for which GTRI is seeking several patents, will allow dentists, orthodontists, technicians and dental labs to design and test treatments virtually in a computer. This will result in treatments that are accurate, fit correctly the first time, and move patients in and out of the chair quickly -- a blessing for both the patient and the dentist, Sitterle said.

The Georgia Tech Research Corporation signed a licensing agreement with DentAART Inc. on Feb. 14 for marketing the enhanced technology. The improvements will help dentists and physicians working with the human face, to "completely capture a patient's anatomy, producing the required diagnostic information and utilize this for the patient's best interest as never before possible," Muecke said.

The collaboration with Georgia Tech may help revolutionize dentistry, he added. "It's exciting, because the same knowledge utilized in other fields of science and industry are now being applied to dentistry. The approach is very exciting and has already produced some breakthroughs."

Muecke has asked Sitterle to join the board of directors of Atlanta-based DentAART Inc., which is launching a program to make DentAART technology available throughout the dental industry.

Based on excitement generated by the virtual mouth project, GTRI launched the Dental Technology Center (known as DenTeC) in July 2001 with Sitterle heading the effort. Six faculty members are already involved, and plans are under way to invite a number of additional researchers to join. The center is focused on four

broad areas that draw research expertise from a number of disciplines - materials, applications of advanced manufacturing, automation of processes and instrumentation.

Among Sitterle's proposed projects that have roots in aerospace engineering is an air abrasion instrument that can erode minor tooth decay. By understanding how to control the flow of air, researchers can design a tool that uses the force of air to remove small spots of decay and then shoots in a spray of sealant. Such a device could be easily used in schools to help children who don't see a dentist regularly.

Another tool under consideration is a multi-spectral sensor that can detect oral cancer. Sitterle's research team may also design stronger, sleeker and quieter dental instruments, and ergonomic dental chairs.

Borrowing a little aerospace technology to improve dentistry will not only make its practitioners more efficient, Sitterle said, it will likely make a trip to the dentist "a lot more affordable to many more people."

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**Technical Contacts:**

- 1) Jeffrey J. Sitterle, Georgia Tech Research Institute (404-894-7136):  
E-mail: jeffrey.sitterle@gtri.gatech.edu
- 2) Dr. Randy Muecke (404-256-2400): E-mail: rmuecke@dentaart.com
- 3) Dr. David Leever (813-988-9136): E-mail: dleever@dentaart.com
- 4) Ken Allen, DentAART Media Inquiries (704-347-2500): E-mail: kenallen@allenagency.org
- 5) Jim Deupree, CEO of DentAART Inc. (704-904-6555): E-mail: jdeupree@dentaart.com

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